WATER DISCHARGE MEASUREMENT OF COMMUNITY SPRINGS ALONG HRT ALIGNMENT

(March-April 2022)

FOR

Upper Trishuli 1 Hydropower Project (216 MW)

BY

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Water Discharge Measurement of Community Springs Along HRT Alignment

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Water Discharge Measurement of Community Springs Along HRT Alignment

1. Introduction

The CESMMP – Water Quality Management Plan and ESIA states that, there were number of springs identified along the tunnel alignment that were used by local communities for drinking water, irrigation, and water supply for livestock and wildlife. The current study is focused to verify the current discharge of the springs and ensure that that there is no any impact to water source due to the ongoing construction activities. The spring sources which were monitored during March-April were:

1. Kulumul-1 spring
2. Kulumul-2 spring (new)
3. Braju spring (new)
4. Phulbari spring
5. Majhowa spring
6. Semdong spring (new)
7. Gansing spring
8. Thankukhola spring
9. Peepalbot Spring
10. Pamrang Spring (new)
11. Chirwati Spring
12. Kakasong Spring
13. Gulunglung Spring
14. Simle Spring (new)

2. Field Verification and Measurement

The water sources which were identified during the baseline monitoring were traced and discharge monitoring was conducted. All the identified 14 water sources were covered to assess the water level during the dry season.

The monitoring was conducted in presence of representative from OE, DE, PC and local representative. The discharge measurement of identified water sources was carried out on 19 March 2023 and 17 April 2023.

3. Methods

3.1 Area-Velocity Method:

A commonly applied methodology for measuring, and estimating, the discharge of a river is based on a simplified form of the continuity equation. The equation implies that for any incompressible fluid, such as liquid water, the discharge (Q) is equal to the product of the stream's cross-sectional area (A) and its mean velocity (v), and is written as:
where,

- Q is the discharge ($[L^3T^{-1}]$; m^3/s or ft^3/s or L/s)
- A is the cross-sectional area of the portion of the channel occupied by the flow ($[L^2]$; m^2 or ft^2)

- v is the average flow velocity ([LT^{-1}]; m/s or ft/s)

3.2 Volumetric Method:

The volumetric flow rate (also known as volume flow rate, rate of fluid flow, or volume velocity) is the volume of fluid that passes per unit of time; usually, it is represented by the symbol Q (sometimes $\dot{V}$). The SI unit is cubic meters per second (m3/s). In hydrometric, it is known as discharge. To calculate the discharge using this method, we need to know the volume of the vessel (V) used and the time taken (t) to fill the vessel. From that, we can calculate discharge using the formula.
Discharge (Q) = Volume (V)/Time (T)

4. Details of Discharge Measurement

4.1 Source 1: Kulumul-1 spring

Monitoring Date: 17.04.2023
Location: Hakubesi
GPS: 28° 6'48.77"N and 85°16'29.54"E
Dependent household: 2
Method: Volumetric
Month: April, 2023

Picture 1: Kulumul-1 Water Spring

S.N.	The volume of the Vessel (L)	The average time taken to fill up (s)	Discharge (L/s)
1.	1.8	21.78	0.082
Total discharge of source 1 (L/s)			**0.082**

Detail Calculation for source 1:

Volume (V) = 1.8 L = Volume of the Vessel used

Time taken to fill the vessel (t) = 21.78 sec

Discharge (Q) =Volume (L) / Time (t)

Therefore, Discharge of Source 1 = 1.8 L / 21.78 s = 0.082 L/s

4.2 Source 2: Kulumul-2 spring

Date: 17.04.2023
Location: Hakubesi
GPS: 28° 6'49.07"N and 85°16'30.05"E
Dependent household: 0
Method: Volumetric
Month: April, 2023

Picture 2: Kulumul 2 Water Spring

S.N.	Volume of the Vessel (L)	Average time taken to fill up (s)	Discharge (L/s)
1.	1.8	23.03	0.078
Total discharge of source 2 (L/s)			**0.078**

Detail Calculation for source 2:

Volume (V) = 1.8 L = Volume of the Vessel used

Time taken to fill the vessel (t) = 23.03 sec

Discharge (Q) =Volume (L) / Time (t)

Therefore, Discharge of Source 2 = 1.8 L / 23.03 sec =0.078 L/s

4.3 Source 3: Braju spring (Prajo)

Date: 17.04.2023
Location: Fulbari
GPS: 28° 7'10.76"N and 85°17'0.63"E
Dependent household: 2
Method: Volumetric
Month: April, 2023

Picture 3: Braju Spring (Prajo)

S.N.	Volume of the Vessel (L)	Average time taken to fill up (s)	Discharge (L/s)
1.	1.8	4.87	0.37
Total discharge of source 3 (L/s)			**0.37**

Volume (V) = 1.8 L = Volume of the Vessel used

Time taken to fill the vessel (t) = 4.87 sec

Discharge (Q) =Volume (L) / Time (t)

Therefore, Discharge of overflow of Source 3 = 1.8 L / 4.87 s = 0.37 L/s

4.4 Source 4: Phulbari spring

Date: 17.04.2023
Location: Hakubesi
GPS: 28° 7'10.73"N and 85°17'0.38"E
Dependent household: 2
Method: Volumetric
Month: April, 2023

Picture 4: Phulbari Spring

S.N.	Volume of the Vessel (L)	Average time taken to fill up (s)	Discharge (L/s)
1.	1.8	16.62	0.11
Total discharge of source 4 (L/s)			**0.11**

Volume (V) = 1.8 L = Volume of the Vessel used

Time taken to fill the vessel (t)= 16.62

Discharge (Q) =Volume (L) / Time (t)

Therefore, Discharge of overflow of Source 4 = 1.8 L / 16.62 s = 0.11 L/s

4.5 Source 5: Majhowa spring

Date: 17.04.2023
Location: Hakubesi
GPS: 28° 7'9.92"N and 85°17'3.32"E
Dependent household: 2
Method: Volumetric
Month: April, 2022

Picture 5: Majhowa Spring

S.N.	Volume of the Vessel (L)	Average time taken to fill up (s)	Discharge (L/s)
1.	1.8	21.97	0.082
Total discharge of source 5 (L/s)			**0.082**

Volume (V) = 1 L = Volume of the Vessel used

Time taken to fill the vessel (t)= 21.97

Discharge (Q) =Volume (L) / Time (t)

Therefore, Total Discharge from Source 5 = 1.8 L/ 21.97 s = 0.82 L/s

4.6 Source 6: Semdong Spring

Date: 17.04.2023
Location: Hakubesi
GPS:28°7'8.93" N and 85°17'4.95"E
Dependent household: 1
Method: Volumetric
Month: April, 2022

Picture 6: Semdong Spring

S.N.	Volume of the Vessel (L)	Average time taken to fill up (s)	Discharge (L/s)
1.	1.8	23.85	0.075
Total discharge of source 6 (L/s)			**0.075**

Volume (V) = 1.8 L = Volume of the Vessel used

Time taken to fill the vessel (t)= 23.85

Discharge (Q) =Volume (L) / Time (t)

Therefore, Total Discharge from Source 6 = 1.8 L/ 23.85 s = 0.075 L/s

4.7 Source 7: Gansing spring

Date: 17.04.2023
Location: Fulbari
GPS: 28° 7'9.22"N and 85°17'9.97"E
Dependent household: 1
Method: Volumetric
Month: April, 2023

Picture 7: Gansing Spring

S.N.	Volume of the Vessel (L)	Average time taken to fill up (s)	Discharge (L/s)
1.	1.8	25.57	0.07
Total discharge from source 7 (L/s)			**0.07**

Volume (V) = 1 L = Volume of the Vessel used

Time taken to fill the vessel (t)= 25.57

Discharge (Q) =Volume (L) / Time (t)

Therefore, Total Discharge from Source 7 = 1.8 L/ 25.57 s = 0.07 L/s

4.8 Source 8: Thankukhola Spring

Date: 17.04.2023
Location: Thanku
GPS: 28° 6'46.76"N and 85°16'37.93"E
Dependent household: None
Method: Area-velocity method
Month: April, 2022

Picture 8: Thankukhola Spring

S.N.	Cross section area (L)	Distance of flow (m)	Average time taken (s)	Velocity (m/s)	Discharge (m^3/s)
1.	1.78×0.14=0.249	3	5.11	0.58	0.144536
Total discharge of overflow from source 8 (L/s)					**258.89**

Therefore, Total discharge from source 8 = V/t = 1069.2 L/ 4.13 s = 258.89 L/s

4.9 Source 9: Peepalbot spring

Date: 17.04.2023
Location: Hakubesi
GPS: 28° 7'9.67"N and 85°17'9.48"E
Dependent household: None
Method: None
Month: April, 2023
Status: Dry

Picture 9: Peepalbot Spring

The local peoples stated that the spring was entrapped due to landslide after earthquake and no any household was found to be dependent on Peepalbot spring before landslide also.

4.10 Source 10: Pamrang Spring

Date: 30.12.2022
Location: Pamrang
GPS: 28° 5'19.88"N and 85°13'11.67"E
Dependent household: 1
Method: Volumetric
Season: Winter/Dry
Month: December, 2022

Picture 10: Pamrang Spring

The status of the spring is almost dry. The photograph was taken for the evidence.

4.11 Source 11: Chirwati Spring

Date: 19.03.2023
Location: Gogane
GPS: 28° 5'22.51"N and 85°13'16.43"E
Dependent household: None
Method: Volumetric
Season: Dry
Month: March, 2023

Picture 11: Chirwati Spring

S.N.	Volume of the Vessel (L)	Average time taken to fill up (s)	Discharge (L/s)
1.	1.8	6.46	0.28
Total discharge of source 11 (L/s)			**0.28**

Detail Calculation for source 11:

Volume (V) = 1.8 L = Volume of the Vessel used

Time taken to fill the vessel (t) = 6.46 s

Discharge (Q) =Volume (L) / Time (t)

Therefore, Discharge of Source 11 = 1.8 L / 6.46 s = 0.28 L/s

4.12 Source 12: Kakasong Spring

Date: 19.03.2023
Location: Gogane
GPS: 28° 5'24.39"N and 85°13'23.76"E
Dependent household: 4
Method: Volumetric
Season: Dry
Month: March, 2023

Picture 12: Kakasong Spring

S.N.	Volume of the Vessel (L)	Average time taken to fill up (s)	Discharge (L/s)
1.	1.8	9.146	0.19
Total discharge from source 12 (L/s)			**0.19**

Volume (V) = 1.8 L = Volume of the Vessel used

Discharge (Q) =Volume (L) / Time (t)

Therefore, Discharge of overflow of Source 12 = 1.8 L / 9.146 s = 0.19 L/s

4.13 Source 13: Gulunglung Stream

Date: 19.03.2023
Location: Gogane
GPS: 28° 5'24.55"N and 85°13'30.94"E
Purpose: Water mill
Method: Area velocity
Season: Dry
Month: March, 2022

Picture 13: Gulunglung stream

S.N.	Cross section area (L)	Distance of flow (m)	Average time taken to fill up (s)	Velocity(m/s)	Discharge (m^3/s)
1.	0.07	3	8.93	0.34	0.0238

Discharge in litres per second= 0.0238×1000
Therefore, Total discharge from source 13 = 23.8 L/s

4.14 Source 14: Simle Spring

Date: 19.03.2023
Location: Gogane (Near 3+500 camp)
GPS: 28° 5'23.45"N and 85°13'46.34"E
Dependent household: 0
Method: Volumetric
Season: Dry
Month: March, 2022

Picture 14: Simle Spring

S.N.	Volume of the Vessel (L)	Average time taken to fill up (s)	Discharge (L/s)
1.	1.8	22.28	0.08
Total discharge from source 14 (L/s)			**0.08**

Volume (V) = 1.8 L = Volume of the Vessel used

Time (t) = 22.28 s

Discharge (Q) =Volume (L) / Time (t)

Therefore, Total Discharge from Source 14 = 0.08 L/s

ATTACHMENT 1: RECORD OF PREVIOUS READINGS

	2022/6/26	2022/12/31	2023/3/4
Kulumul-1 spring	0.15	0.055	0.082
Kulumul-2 spring (new)	0.115	0.087	0.078
Braju spring (new)	0.89	0.24	0.39
Phulbari spring	0.062	0.091	0.11
Majhowa spring	0.487	0.235	0.081
Semdong spring (new)	0.098	0.112	0.075
Gansing spring	0.072	0.085	0.07
Thankukhola spring	328.25	258.89	144.53
Peepalbot Spring	0	0	0
Pamrang spring (new)	0	0	0
Chirwati spring	0.09	0.083	0.28
Kakasong spring	0.2	0.22	0.19
Gulunglung spring	1.415	32.9	23.8
Simle spring (new)	0.22	0.225	0.08

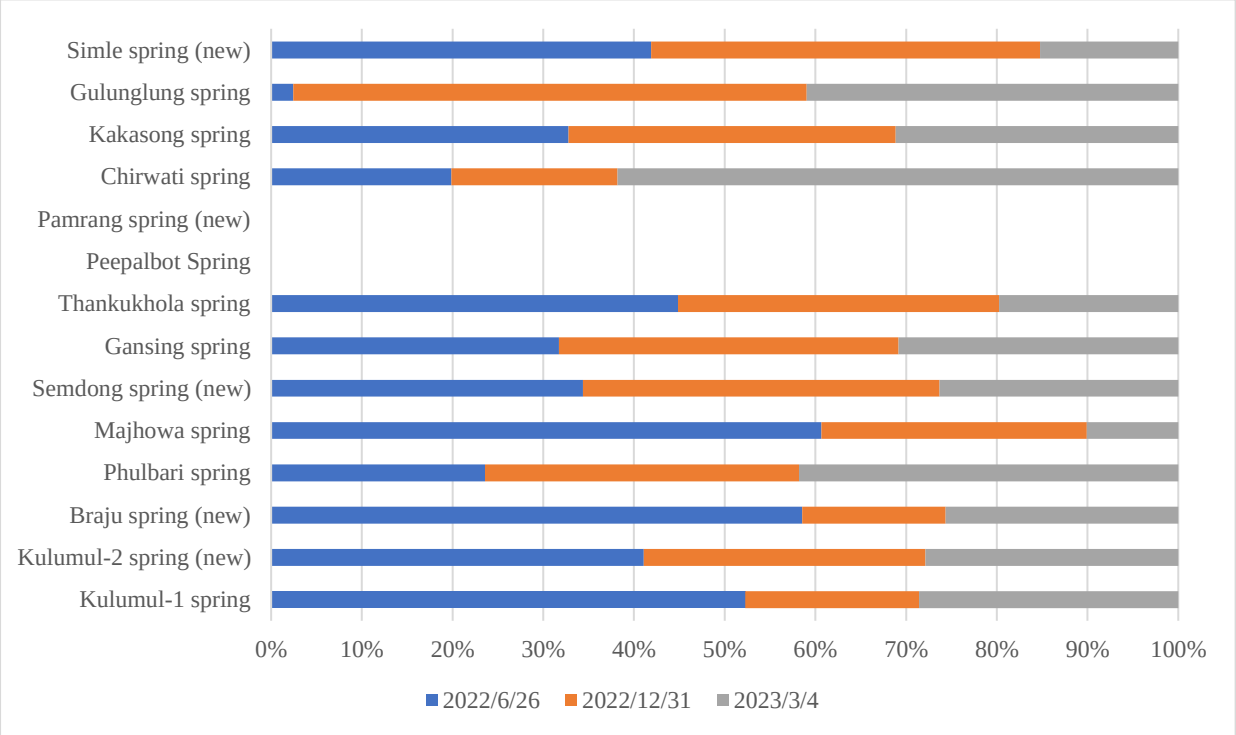
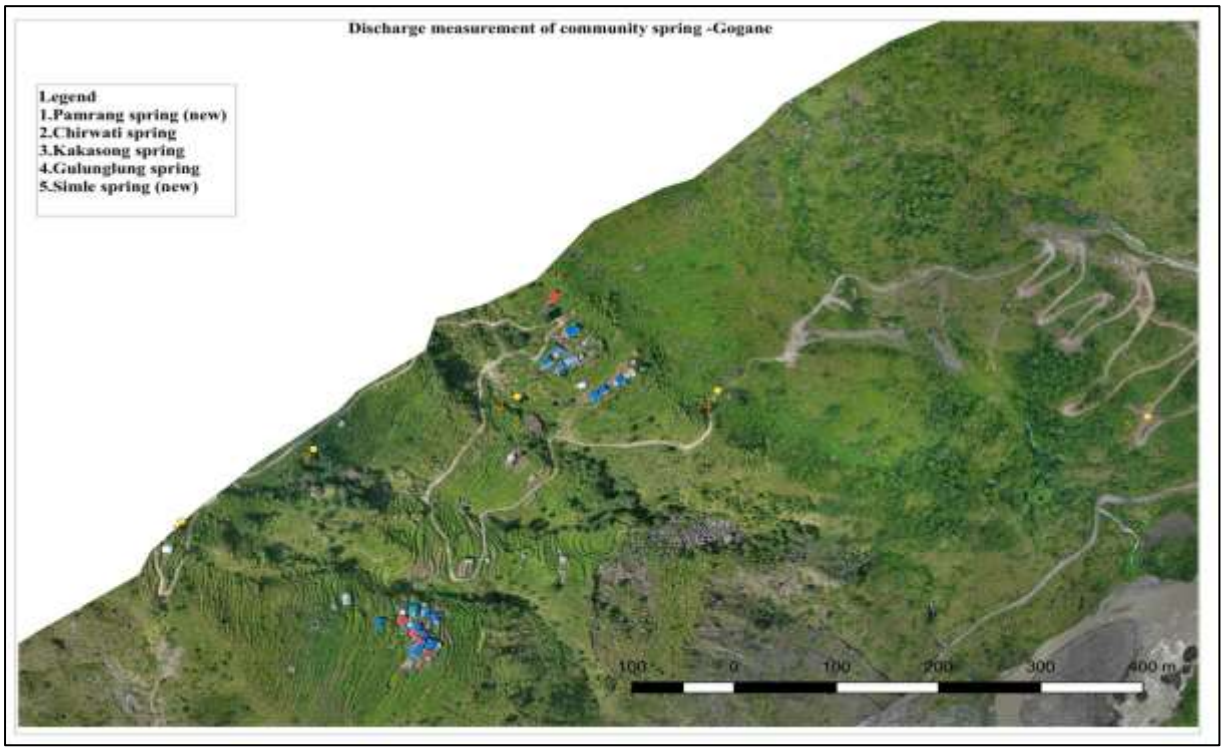
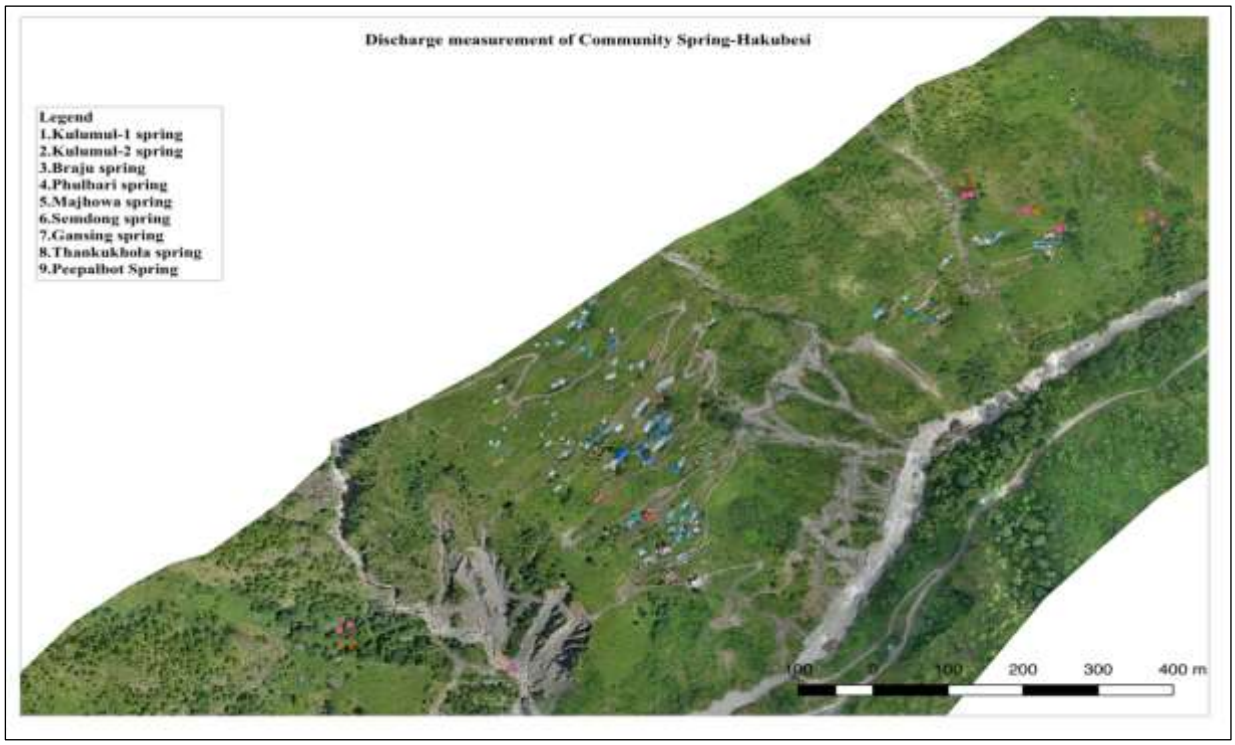


Figure 1: Graphical representation of change in discharge

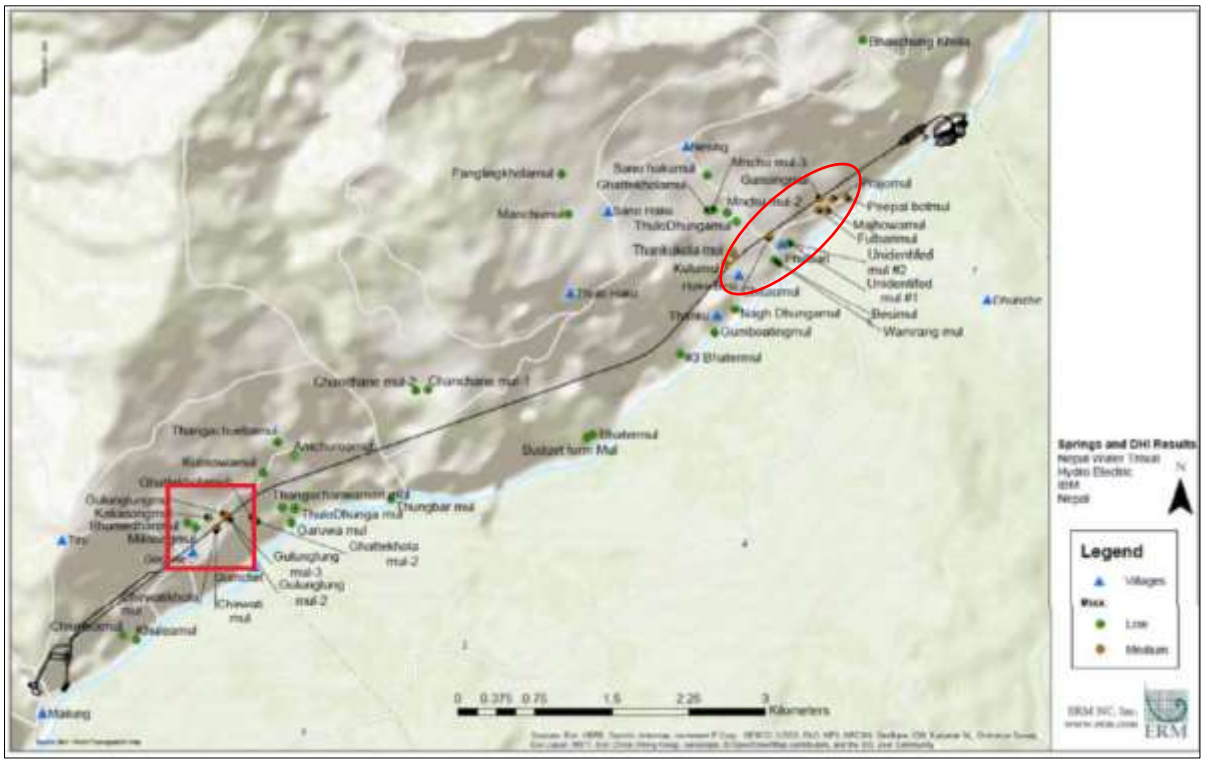
ATTACHMENT 2: MAP SHOWING MONITORING LOCATION



Map 1: Water source located in Gogane



Map 2: Water source located in Hakubesi/Fulbari



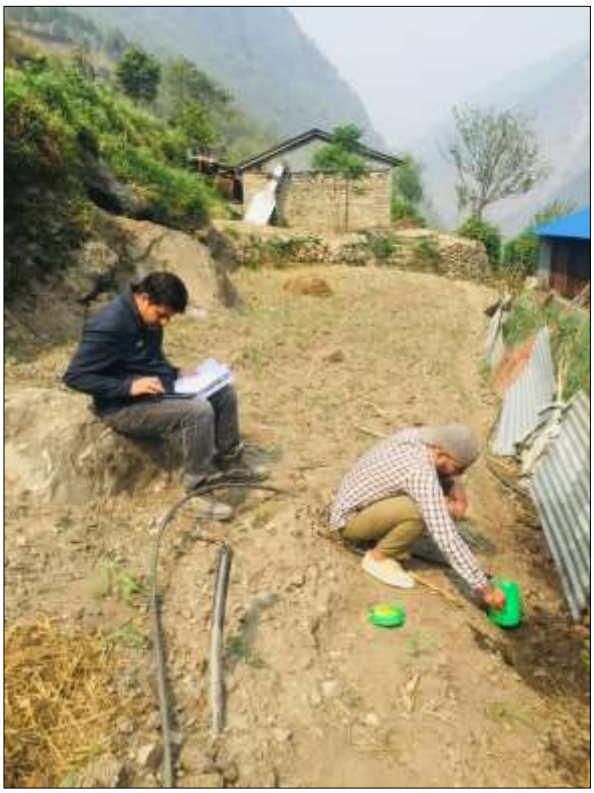
Map 3: Medium risk water springs described in ESIA

ATTACHMENT 3: DETAIL OF MONITORING TEAM

S.N.	Name	Signature
1	Sudip Gautam	
2	Rup Raj Timilsina	
3	Santosh Tamang	
4	Nirmal Lama	
5	Sonam Ghale	
6	Bodh Bahadur Tamang	
7	Aaditya Dawadi	

ATTACHMENT 4: REFERENCE PHOTOGRAPHS

Water Discharge Measurement of Community Springs Along HRT Alignment



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